DEFENSE ADVANCED RESEARCH PROJECTS AGENCY

Proposal Submission

DARPA's charter is to help maintain U.S. technological superiority over, and to prevent technological surprise by, its potential adversaries. Thus, the DARPA goal is to pursue as many highly imaginative and innovative research ideas and concepts with potential military and dual-use applicability as the budget and other factors will allow.

DARPA has identified technical topics to which small businesses may respond in the fiscal year (FY) 2003 solicitation. Please note that these topics are UNCLASSIFIED and only UNCLASSIFIED proposals will be entertained. Although they are unclassified, the subject matter may be considered to be a "critical technology." If you plan to employ NON-U.S. Citizens in the performance of a DARPA STTR contract, please inform the Contracting Officer who is negotiating your contract. These are the only topics for which proposals will be accepted at this time. A list of the topics currently eligible for proposal submission is included followed by full topic descriptions. The topics originated from DARPA technical program managers and are directly linked to their core research and development programs.

NEW REQUIREMENT: ALL PROPOSAL SUBMISSIONS TO DARPA MUST BE SUBMITTED ELECTRONICALLY. PROPOSALS WHICH ARE NOT SUBMITTED THROUGH THE ON-LINE WEBSITE WILL NOT BE ACCEPTED.

It is mandatory that the complete proposal submission -- DoD Proposal Cover Sheet, **ENTIRE** Technical Proposal with any appendices, Cost Proposal, and the Company Commercialization Report -- be submitted electronically through the DoD SBIR website at http://www.dodsbir.net/submission. Each of these documents is to be submitted separately through the website. Your complete proposal **must** be submitted via the submissions site on or before the **5:00pm EST, 16 April 2003 deadline. In addition, one signed copy of the entire proposal should be mailed to the address listed below or hand-carried to DARPA.** The hard copy submission is not considered a replacement for the on-line submission; it is only considered a signed copy. A checklist has been prepared to assist small business activities in responding to DARPA topics. If you have any questions or problems with electronic submission, contact the DoD SBIR Help Desk at 1-866-724-7457 (8am to 5pm EST).

The responsibility for implementing DARPA's Small Business Technology Transfer (STTR) Program rests with the Contract Management Office. The DARPA SBIR/STTR Program Manager is Connie Jacobs. DARPA invites small businesses, in cooperation with a researcher from a university, an eligible contractor-operated federally funded research and development center (FFRDC), or a non-profit research institution, to send proposals directly to DARPA at the following address:

DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Attention: CMO/SBIR/STTR
3701 North Fairfax Drive
Arlington, VA 22203-1714

(703) 526-4170
Home Page http://www.darpa.mil

Acceptable Format for On-Line Submission: All technical proposal files must be in Portable Document Format (PDF) for evaluation purposes. The Technical Proposal should include all graphics and attachments but should not include the Cover Sheet or Company Commercialization Report (as these items are completed separately). Cost Proposal information should be provided by completing the on-line Cost Proposal form. This itemized listing should be placed as the last page(s) of the Technical Proposal Upload. (Note: Only one file can be uploaded to the DoD Submission Site. Ensure that this single file includes your complete Technical Proposal and the additional cost proposal information.)

Technical Proposals should conform to the limitations on margins and number of pages specified in the front section of this DoD solicitation. However, your cost proposal will only count as one page and your Cover Sheet will only count as two, no matter how they print out after being converted. Most proposals will be printed out on black and white printers so make sure all graphics are distinguishable in black and white. It is strongly encouraged that you

perform a virus check on each submission to avoid complications or delays in submitting your Technical Proposal. To verify that your technical proposal has been received, click on the "Check Upload" icon to view your proposal. Typically, your proposal will be uploaded within the hour. However, if your proposal does not appear after an hour, please contact the DoD Help Desk.

DARPA recommends that you complete your submission early, as computer traffic gets heavy near the solicitation closing and slows down the system. **Do not wait until the last minute.** DARPA will not be responsible for proposals being denied due to servers being "down" or inaccessible. Please assure that your e-mail address listed in your proposal is current and accurate. By the end of March, you will receive an e-mail acknowledging receipt of your proposal.

Additional DARPA requirements:

- DARPA Phase I awards will be Firm Fixed Price contracts.
- Phase I proposals **shall not exceed $99,000,** and may range from 8 to 12 months in duration. Phase I contracts cannot be extended.
- DARPA Phase II proposals must be invited by the respective Phase I technical monitor (with the exception of Fast Track Phase II proposals – see Section 4.5 of this solicitation). Phase II STTR awards will generally be limited to $500,000. It is expected that a majority of the Phase II contracts will be Cost plus fixed Fee, however, DARPA may choose to award a Firm Fixed Price Contract or an Other Transaction, on a case-by-case basis.

Prior to receiving a contract award, the small business **MUST** be registered in the Centralized Contractor Registration (CCR) Program. You may obtain registration information by calling 1-888-227-2423 or Internet: http://www.ccr.gov.

STTR proposals submitted to DARPA will be processed by DARPA and distributed to the appropriate technical office for evaluation and action.

DARPA selects proposals for funding based on technical merit and the evaluation criteria contained in this solicitation document. DARPA gives evaluation criterion a., "The soundness, technical merit, and innovation of the proposed approach and its incremental progress toward topic or subtopic solution" (refer to section 4.2 Evaluation Criteria - Phase I - page 7), twice the weight of the other two evaluation criteria. **TRANSITION OF THE PROPOSED EFFORT IS VERY, VERY IMPORTANT. THE SMALL BUSINESS SHOULD INCLUDE THEIR TRANSITION VISION IN THEIR COMMERCIALIZATION STRATEGY. THE SMALL BUSINESS MUST UNDERSTAND THE END USE OF THEIR EFFORT AND THE END USER, i.e., ARMY, NAVY, AF, SOCOM, ETC.**

As funding is limited, DARPA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and highly relevant to the DARPA mission. As a result, DARPA may fund more than one proposal in a specific topic area if the technical quality of the proposal(s) is deemed superior, or it may not fund any proposals in a topic area. Each proposal submitted to DARPA must have a topic number and must be responsive to only one topic.

- Cost proposals will be considered to be binding for 180 days from closing date of solicitation.
- **Successful offerors will be expected to begin work no later than 30 days after contract award.**
- For planning purposes, the contract award process is normally completed with 45 to 60 days from issuance of the selection notification letter to Phase I offerors.

DARPA FY2003 Phase I STTR
Checklist

Page Numbering

- Number all pages of your proposal consecutively _____
  Total for each proposal is 25 pages inclusive of cost proposal and resumes
  Beyond the 25 page limit do not send appendices, attachments and/or additional references
  Company Commercialization Report **IS NOT** included in the page count

Proposal Format

b. Cover Sheet **MUST** be submitted electronically _____
(identify topic number)

c. Identification and Significance of Problem or Opportunity _____

d. Phase I Technical Objectives _____

e. Phase I Work Plan _____

f. Related Work _____

g. Relationship with Future Research and/or Development _____

h. Commercialization Strategy _____

i. Key Personnel, Resumes _____

j. Facilities/Equipment _____

k. Consultants _____

l. Prior, Current, or Pending Support _____

m. Cost Proposal. Ensure your cost proposal is signed. _____

n. Company Commercialization Report **MUST** be registered electronically and a signed hardcopy hardcopy submitted with your proposal (register at http://www.dodsbir.net/submission/) _____

o. Agreement between the Small Business and Research Institution _____

Bindings

- Staple proposals in upper left-hand corner _____
  DO NOT use a cover
  DO NOT use special bindings

Submission Requirement for Each Proposal

- Electronic Submission trough www.dodsbir.net/submission _____
- Original proposal (including signed Coversheet) _____
- Signed Cost Proposal
- Company Commercialization Report _____

DARPA 2003 STTR TOPICS

DARPA ST031-001	Commercial Development of Stabilized Cellular Diagnostics and Therapeutics to Lessen Logistical Burden on the Battlefield
DARPA ST031-002	COTS-Based Multilingual Translator for Military/Industrial Application
DARPA ST031-003	Development of a Common Specification Method for Data Flow Graph Exchange
DARPA ST031-004	Automated Video Surveillance at Night

SUBJECT/WORD INDEX TO THE DARPA FY2003 STTR TOPICS

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ASR Machine Translation	2
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Automatic Speech Recognition	2
Biomaterials	1
Blood	1
Computer Vision	4
Data Flow Graphs	3
Diagnostics	1
Drugs	1
Low-Light Cameras	4
MT	2
One-Way Translation	2
Parallel Computing Models	3
Parsing and Code Generation	3
PDA	2
Personal Digital Assistant	2
Phraselator	2
Physical Security	4
Stabilization	1
Therapeutics	1
Two-Way Translation	2
Video Surveillance	4

DARPA 2003 STTR TOPIC DESCRIPTIONS

DARPA ST031-001 TITLE: Commercial Development of Stabilized Cellular Diagnostics and Therapeutics to Lessen Logistical Burden on the Battlefield

TECHNOLOGY AREAS: Chemical/Bio Defense, Materials/Processes, Biomedical

OBJECTIVE: The goal of this effort is to develop methodology for commercially viable long-term functional storage of cellular biosensors, medical diagnostics and therapeutics for field applications.

DESCRIPTION: Many Defense applications (e.g. sensors, diagnostics, therapeutics) utilize biological assays and systems (antibodies, proteins, cells, tissues and organs) that require significant stabilization to assure functionality when transported and delivered to the field. Significant logistics burden are associated with their distribution and effective use including weight, volume, the need for continued refrigeration, and reduced shelf life. The goal of this effort is to provide new technologies, materials and methods that result in the dry stabilization of a wide variety of biomolecular, cellular and tissue based Defense products. Of particular interest is the development of the most appropriate steps needed for broad commercial application and distribution of these stabilized products including manufacturing methods at the Good Manufacturing Practices (GMP) level, and models of animal safety and efficacy at the Good Laboratory Practices (GLP) level. The development of these stabilized products will result in much wider availability and applicability and a significant reduction in the logistics burden associated with transportation and delivery. The following areas are also of interest: the discovery and application of new biocompatible low molecular weight stabilization; new genomic, proteomic and metabolomic methods leading to the rapid discovery and characterization of new chemical species that stabilize biologics; new methods and techniques for introducing these compounds into cells and tissues resulting in the long-term stabilization, maintenance and recovery of biological structure and function in stored materials. Particular areas of focus are in acellular and cellular blood products (platelets, erythrocytes and hematopoeitic stem cells), diagnostics (biomolecular and cell based assays), and therapeutics (biologics and pharmaceuticals).

Performance metrics include the following: one year storage of biological products and cells at room temperatures in a dry state. Rehydrated cells should be recovered at 95% of the pre- stored level. For example: Rehydrated platelets should demonstrate a circulating half life at least 50% of circulating fresh platelets. Efficacy of hemostasis by clotting times should be near 80% of fresh platelets in appropriate pre-clinical tests in animal models. Rehydrated platelets should demonstrate growth factor secretion at level that demonstrates functional competency of the cell.

PHASE I: Conduct a feasibility study of new materials and methods that are applicable to temperature and hydration stabilization of biomolecular, cellular, and tissue biologics (sensors, diagnotics, and therapeutics) for particular diagnostic and clinical applications.

PHASE II: Demonstrate new materials and methods of the long-term stabilization of Defense relevant biologics including blood, blood products, diagnostic assays, and therapeutics. Demonstrations could include blood, blood products, diagnostics, or therapeutics in models of pre-clinical animal safety and efficacy, at scales appropriate for commercial product development.

PHASE III DUAL USE APPLICATIONS: There is both military and commercial application for this technology. The stable long-term preparation of certain blood components (e.g. platelets, red blood cells) could dramatically benefit the supply and safety of the blood supply. For blood components, rapid stabilization immediately following collection could dramatically reduce both bacterial or viral contaminants. The clinical demand is currently limited by both supply (number of available donors) and the products' limited shelf life. The ability to store these products for long periods without degradation could have significant impact on both military and civilian populations. Dried biologics will also enable new applications in hemorrhage control, wound repair, bandages and reagents for diagnostics which have significant commercial markets of interest.

REFERENCES:
1. "Membrane reorganization during chilling: Implications for long term stabilization of platelets" ISSN: 0011-2240. Available interlibrary loan.

2. Oliver, A.E., O. Leprince, W.F. Wolkers, D.K. Hincha, A.G. Heyer, and J. H. Crowe. 2001. Non-disaccharide based mechanisms of protection during drying. Crybiology 43: 151-167. Available interlibrary loan.
3. Gousset, K., W.F. Wolkers, N.M. Tsvetkova, A. E. Oliver, N. J. Walker, J. H. Crowe, and F.Tablin. 2002. Evidence for a physiological role for membrane rafts in human platelets. J. Cell. Physiol. 190: 117-128. Available interlibrary loan.
4. "From an hydrobiosis to freeze-drying of eukaryotic cells", ISSN: 1095-6433. Available interlibrary loan.

KEYWORDS: Stabilization, Biomaterials, Diagnostics, Blood, Drugs and Therapeutics

DARPA ST031-002 TITLE: COTS-Based Multilingual Translator for Military/Industrial Application

TECHNOLOGY AREAS: Information Systems, Sensors, Electronics, Battlespace

ACQUISITION PROGRAM:

OBJECTIVE: Evaluate the feasibility of and then prototype a noise robust, hand-held translation device leveraging the technologies and ergonomic designs developed for the DARPA Phraselator and package this device using Commercial-Off-The-Shelf (COTS) resources to create a low-cost rapidly adaptable system capable wide distribution. This alternative configuration must enhance multilingual automatic speech recognition (ASR) and multilingual translation by overcoming noise and other environmental effects that hinder ASR accuracy in current state of the practice systems.

DESCRIPTION: The DARPA Phraselator was developed under a previous SBIR and a rapid development program. The current system incorporates state of the art components and algorithms that support military operations in very harsh environments. A feasibility study is needed to evaluate the design, production and performance of a COTS-based alternative to the Phraselator that could be produced and maintained at a greatly reduced cost. It is hoped that proposals could cut the lifecycle costs of this new product by at least 50% of the current Phraselator costs.

PHASE I: Prepare and execute a feasibility study to evaluate alternative designs and production methods to enhance end-user performance and total lifecycle costs for delivering hand-held translation devices for military and harsh industrial applications.

PHASE II: Design a functional prototype translator as a low-cost alternative to the Phraselator complementing the level of support to the soldier based on the need for a fully hardened vs. an industrial ruggidized device. The prototype needs to be useable in an outdoor or field environment for short demos to validate usability and performance. After the prototype passes the field and usability demos, the program will support both military and commercial exploitation depending on the success of the prototype. The units will be field tested and feedback may be obtained for further refinement. Iterative refinement will be continued as funding permits.

PHASE III DUAL USE APPLICATIONS: The success of the Phraselator represents the enabling technology to create low-cost industrial-hardened hand-held translation devices. If found usable in our military evaluations, these devices will have an immediate market in the commercial world for use in industrial, tourist, and law enforcement applications.

REFERENCES:
1. “The Phraselator: Translation system put to the test on the front lines in Afghanistan,” Washington Technology (Washington Post), by Rob Terry, www.washtech.com.
2. www.phraselator.com.
3. http://www.sarich.com/translator/DOW%20web%20brief%20Oct%2099/.
4. http://www.wirelesssolutionsjournal.com/articles/issue2/ADS-Militarized_PDA-Story.pdf.

KEYWORDS: Personal Digital Assistant, PDA, Automatic Speech Recognition, ASR, Machine Translation, MT, Phraselator, One-Way Translation, Two-Way Translation

DARPA ST031-003 TITLE: Development of a Common Specification Method for Data Flow Graph Exchange

TECHNOLOGY AREAS: Information Systems

ACQUISITION PROGRAM:

OBJECTIVE: To (1) develop a generic method for data flow graph specifications for high performance applications involving real time and data intensive processing, and (2) demonstrate tool and compilation support for its industrial use in reusing data flow graph programs.

DESCRIPTION: Data flow graphs have become a common method for top level conceptualization of high performance applications ranging from real time sensor information processing to large scale computationally intense simulation and modeling. Despite well demonstrated productivity gains and software/hardware synthesis potential that data flow graph based development methodologies and software tools offer software architectures for many high performance applications are commonly described as manually generated data flow graphs and then implemented using standard practice. There are a number of data flow based tools and environments in both academia and industry, e.g. Ptolemny, SPE, PVL, Autocoding Toolset, RIPPEN, GEDAE, Dataflo, CoreFire, Signal, Processing Worksystem, COSSAP, Agilent ADS, etc. that are based on the common mathematical foundations of data flow. However they all use different specification languages and or iconic specification methods. There is no common means of exchanging programs among tools and environments short of manual translation. The lack of an industry standard data flow language is inhibiting the acceptance and further development of powerful data flow based codesign methods and tools that can be instrumental in advancing high performance computing. Developers, who are reluctant to become dependent on individual firm's or institution's tools and methods, would welcome the productivity they offer if they supported an industry standard data flow language specification method. A vendor independent data flow specification method capable of becoming an industry standard is viewed as an essential key to harnessing this powerful programming technology to emerging high performance computing requirements.

PHASE I: Feasibility study to define a generic data flow graph method for expressing a broad range of high performance applications.

PHASE II: Based on the results of Phase I, develop a generic data flow graph specification method. Demonstrate its feasibility for exchanging data flow designs between independent tools. Implement parsing and code generation support for two or more data flow environments to demonstrate vendor independent reuse of data flow programs.

PHASE III: DUAL USE APPLICATIONS: In Phase III, the generic data flow graph specification method should be promoted as an industry standard. The data flow specification method may be incorporated in data flow based software tools to enhance their commercial appeal. The notation and support developed in Phase II will be immediately reusable in DARPA and other DoD programs addressing high performance computing applications.

REFERENCES:

1. SIAM Journal of Applied Mathematics: ISSN: 1390-1411. Available interlibrary loan.
2. J. T. Buck, S. Ha, E. A. Lee, and D. G. Messerschmitt. Ptolemy: A framework for simulating and prototyping heterogeneous systems, International Journal of Computer Simulation, 4:155-182, April 1994. Available on-line at http://citeseer.nj.nec.com/cs.
3. John G. Ackenhusen, Advanced Information Systems Group ERIM International, Inc., Real-Time Signal Processing: Design and Implementation of Signal Processing Systems, Prentice Hall, 1999, Table 11.8. ISBN: 0136317715.
4. S. S. Bhattacharyya. Hardware/software co-synthesis of DSP systems. In Y. H. Hu, editor, Programmable Digital Signal Processors: Architecture, Programming, and Applications, pages 333-378. Marcel Dekker, Inc., 2002. Available on-line at http://citeseer.nj.nec.com/cs.
5. 2. S. S. Bhattacharyya, R. Leupers, and P. Marwedel. Software synthesis and code generation for DSP. IEEE Transactions on Circuits and Systems -- II: Analog and Digital Signal Processing, 47(9):849-875, September 2000. Available on-line at http://citeseer.nj.nec.com/cs.

KEYWORDS: Data Flow Graphs, Parallel Computing Models, Parsing and Code Generation

DARPA ST031-004 TITLE: Automated Video Surveillance at Night

TECHNOLOGY AREAS: Sensors, Electronics, Battlespace

OBJECTIVE: Design and demonstrate a system that contributes to force protection at military facilities by automatically monitoring multiple video feeds for designated events and suspicious activities, even under conditions of darkness.

DESCRIPTION: The use of video surveillance cameras has become routine for maintaining the security of military facilities, government and commercial buildings, retail establishments, and parking structures. These cameras have the potential to observe and record hostile and illegal activities as they happen, and serve as both a deterrent and as a means for pre-empting threats to security at installations that employ them. However, their value in deterring and pre-empting hostile acts goes largely unrealized because the video typically is monitored by an inattentive guard with a bank of TV monitors. As a result, the value of these surveillance cameras is limited to forensic, after-the-fact examination of what occurred.

Recent advances in computer vision, combined with the widespread proliferation of digital security cameras including low-cost infrared and low-light TV, creates an opportunity to dramatically improve security through automated monitoring of the content of video streams. Today, commercially available surveillance systems include the ability to detect motion in selected parts of the scene, to identify people through face recognition, and to identify vehicles by reading license plate numbers. In the future, we expect that significantly more valuable information can be obtained through the automation of more complex monitoring tasks, especially at night. For example, tracking an individual from one camera to the next, discriminating individuals who are loitering, and correlating visual events with other biometrics, are tasks whose solutions cannot be obtained commercially, but could contribute to significantly enhanced security at government facilities. Methods that permit automated monitoring at night through the automatic interpretation of video feeds from low-light and infrared sensors are of particular interest.

The choice of tasks to automate is equally as important as the development of software to automate those tasks, and offerors are expected to be innovative in both the selection of monitoring tasks and in their proposed solutions to those tasks. The research literature is rife with video processing algorithms that have achieved various levels of maturity in the laboratory. It is hoped that this STTR Project will accelerate the emergence of some of these techniques from the laboratory into commercial usage, so that the Department of Defense may benefit through the introduction of tireless, round-the-clock video monitoring of key installations and facilities.

PHASE I: Identify a set of nighttime video monitoring tasks and prepare a feasibility study for a video surveillance system concept to address them. Identify components that are available commercially and those that will need to be developed. Quantify the overall system performance that can be expected and the benefit to the organization employing the system. Determine the appropriate metrics for measuring the performance of components to be developed in Phase II, and the performance levels that would have to be achieved. Describe a prototype for one or more key algorithms within the design.

PHASE II: Finalize the system design from Phase I. Develop and demonstrate all components of the surveillance system, measuring performance on the key metrics identified in Phase I. Assemble the components into an integrated system and demonstrate the performance using live video feeds from a controlled location at night. Prepare a final report documenting the results of both component and system level evaluations.

PHASE III DUAL USE APPLICATIONS: Physical security in the modern world is a common problem faced by military and industrial organizations alike. While the Defense Department organizations have some unique requirements involving detection of military threats, the requirements for video monitoring are quite similar. Successful commercial products developed for industrial use should have direct application to military installations as well.

REFERENCES:

1. Shah, Mubarak, and Ramesh Jain (Eds.), Motion–Based Recognition, Kluwer Academic Publishers, London,1997.

2. Proceedings: 2001 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Lihue, HI, December 10-14, 2001. http://www.ieee.org/organizations/tab/products/confproceedings/titles.html
3. Heyden, G. Sparr, M. Nielsen, P. Johansen (Eds.), Proceedings: 7th European Conference on Computer Vision (ECCV), Copenhagen, Denmark, May 28-31, 2002. http://www.itu.dk/events/eccv02/.

KEYWORDS: Video Surveillance, Physical Security, Automatic Monitoring, Computer Vision, Low-Light Cameras